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EXAMINER	
KIM, DAVID S	

ART UNIT	PAPER NUMBER
2613	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/762,551	FUTAMI ET AL.	
	Examiner	Art Unit	
	David S. Kim	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 November 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. **Claims 1-2 and 10-11** are rejected under 35 U.S.C. 102(b) as being anticipated by Sharma et al. (U.S. Patent No. 6,081,355, hereinafter "Sharma").

Regarding claim 1, Sharma discloses:

A method of providing a multi-wavelength light source, comprising the steps of

modulating an optical pulse source so as to output optical pulses with a designated repetition frequency (e.g., 22 in Fig. 9);

time-division multiplexing the optical pulses output by said optical pulse source by branching (e.g., optical distributor 61) the optical pulses output by said optical pulse source to N paths and multiplexing (e.g., star coupler 62) the branched optical pulses so as to output optical pulses with a repetition frequency which is an integral multiple of said designated repetition frequency fo ("factor of N" in col. 10, l. 29-30), wherein a time difference among the respective paths is 1/(N*(fo)) (a time difference between respective paths is T/N = (1/fo)/N = 1/(N*(fo)) because T is the pulse period, which is the inverse of the pulse frequency fo), and so that intensities and polarization states of the branched optical pulses are equal after being multiplexed (notice the uniform height and co-planar characteristics of the pulses in the pulse diagram above star coupler 62, implying equal intensities and polarization states); and

demultiplexing wavelengths of the optical pulses with the repetition frequency which is the integral multiple of said designated repetition frequency so as to output said wavelengths as the multi-wavelength light source (output in Fig. 9).

Regarding claim 2, Sharma discloses:

An apparatus for providing a multi-wavelength light source, comprising:

an optical pulse source which is modulated so as to output optical pulses with a designated repetition frequency fo (22 in Fig. 9);

a time-division multiplexing unit which branches (e.g., optical distributor 61) the optical pulses output by said optical pulse source to N paths and multiplexes (e.g., star coupler 62) the branched optical pulses so as to output optical pulses with a repetition frequency which is an integral multiple of said designated repetition frequency fo ("factor of N" in col. 10, l. 29-30), wherein a time difference among the respective paths is 1/(N*(fo)) (a time difference between respective paths is T/N = (1/fo)/N = 1/(N*(fo)) because T is the pulse period, which is the inverse of the pulse frequency fo), and so that intensities and polarization states of the branched optical pulses are equal after being multiplexed (notice the uniform height and co-planar characteristics of the pulses in the pulse diagram above star coupler 62, implying equal intensities and polarization states);

and a wavelength demultiplexing unit which demultiplexes wavelengths of the optical pulses with the repetition frequency which is the integral multiple of said designated repetition frequency so as to output said wavelengths as the multi-wavelength light source (output in Fig. 9).

Regarding claims 10-11, claims 10 and 11 are claims that introduce limitations that correspond to the limitations introduced by claims 1 and 2, respectively. Therefore, the recited limitations in claims 1-2 read on the corresponding limitations in claims 10-11.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of

each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. **Claims 3-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharma.

Regarding claims 3-4, Sharma does not expressly disclose:

(claim 3) The apparatus for providing a multi-wavelength light source as claimed in claim 2, wherein said time-division multiplexing unit is a Mach-Zehnder-interferometer-type time-division multiplexing apparatus.

(claim 4) The apparatus for providing a multi-wavelength light source as claimed in claim 2, wherein said time-division multiplexing unit is a Michelson-interferometer-type time-division multiplexing apparatus.

However, these branching time-division multiplexing units are known and common in the art. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to employ any of these or other known and common branching time-division multiplexing units in the apparatus of Sharma. One of ordinary skill in the art would have been motivated to do this since one would recognize that any suitable branching time-division multiplexing unit would provide the basic desired function of providing higher pulse repetition frequency in the apparatus of Sharma (e.g., col. 9, l. 51-52, 64-65; col. 10, l. 4-5, 29-31, 37-40).

Regarding claim 5, Sharma discloses:

The apparatus for providing a multi-wavelength light source as claimed in claim 2, wherein said time-division multiplexing unit time-division multiplexes said optical pulses using a plurality of optical waveguides with different optical path lengths (paths from 61 in Fig. 9)

Sharma does not expressly disclose:

said optical waveguides are arranged in *a planar lightwave circuit.*

However, planar lightwave circuits (PLCs) are well known in the art. Sharma discloses an example (51 in Fig. 8). At the time the invention was made, it would have been obvious to one of ordinary

skill in the art to embody the plurality of optical waveguides of Sharma (paths from 61 in Fig. 9) in a planar lightwave circuit. One of ordinary skill in the art would have been motivated to do this since PLCs provide more component stability than other embodiments of a plurality of optical waveguides, such as loose links of fibers.

6. **Claims 6-8** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharma in view of Morioka et al. ("Multiwavelength picosecond pulse source with low jitter and high optical frequency stability based on 200 nm supercontinuum filtering", hereinafter "Morioka").

Regarding claim 6, Sharma does not expressly disclose:

The apparatus for providing a multi-wavelength light source as claimed in claim 5, wherein said wavelength demultiplexing unit is a wavelength demultiplexer having a multi-peak structure with a center transmission frequency spacing which is the integral multiple of said designated repetition frequency.

However, Morioka discloses the use of an arrayed-waveguide grating (AWG) wavelength demultiplexing unit (Morioka, AWG in Fig. 1). At the time the invention was made, it would have been obvious to one of ordinary skill in the art to employ such a wavelength demultiplexer in the apparatus of Sharma. One of ordinary skill in the art would have been motivated to do this since Sharma cites the use of such a wavelength demultiplexer in the background of the art (AWG of Morioka via col. 1, l. 14-18 of Sharma). Additionally, AWGs have a multi-peak structure with a center transmission frequency spacing. Moreover, the exact value of the frequency spacing of the AWG is a flexible design parameter with a wide range that encompasses the integral multiple of said designated repetition frequency. One reasonable motivation for employing such a frequency spacing is that greater frequency spacing in wavelength demultiplexers, including the frequency spacing of an integral multiple of said designated repetition frequency, is generally associated with less demanding manufacturing and component tolerances, which leads to cheaper costs.

Regarding claim 7, Sharma in view of Morioka discloses:

The apparatus for providing a multi-wavelength light source as claimed in claim 6, wherein said wavelength demultiplexer is an arrayed waveguide grating filter (Morioka, AWG in Fig. 1).

Regarding claim 8, Sharma in view of Morioka does not expressly disclose:

The apparatus for providing a multi-wavelength light source as claimed in claim 7, wherein said planar lightwave circuit and said arrayed waveguide grating filter are provided on one board.

However, the integration of multiple components into one unit/housing/board is an extremely common practice in the art. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to do so with various components in the apparatus of Sharma in view of Morioka. One of ordinary skill in the art would have been motivated to do this since it is well known that integration generally provides benefits such as more compact apparatuses, economies of scale, and faster operation speeds.

7. **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sharma in view of Watanabe et al. (European Patent Application, EP 1 185 007 A2, hereinafter "Watanabe").

Regarding claim 9, Sharma does not expressly disclose:

The apparatus for providing a multi-wavelength light source as claimed in claim 2, further comprising a spectrum-broadening unit which broadens spectrum of the optical pulses which are received at said time-division multiplexing unit, said spreading effected by a non-linear medium having a third-order non-linear effect.

However, such spectrum-broadening units are known in the art, as shown by Watanabe (e.g., nonlinear optical waveguides/fibers in Figs. 2-3, 9, and 15). At the time the invention was made, it would have been obvious to one of ordinary skill in the art to include such a spectrum-broadening unit(s) to broaden the spectrum of the optical pulses which are received by the time-division multiplexing unit of Sharma. One of ordinary skill in the art would have been motivated to do this for any variety of exemplary beneficial applications disclosed in Watanabe, such as suppression of a reduction in optical signal-to-noise ratio (Fig. 2 and paragraph [0040]) and noise removal (Figs. 3-4 and paragraphs [0044-0049]). Additionally, a broader spectrum in the apparatus of Sharma could lead to a wavelength demultiplexing unit with less narrow frequency spacing requirements, which is generally associated with less demanding manufacturing and component tolerances, which leads to cheaper costs.

8. **Claim 12** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sharma in view of Hall et al. (U.S. Patent Application Publication No. 2002/0003641 A1, hereinafter "Hall").

Regarding claim 12, Sharma does not expressly disclose:

An apparatus as in claim 2, further comprising a polarization controller through which the optical pulses output by said optical pulse source pass, and a variable optical attenuator and a variable delay unit arranged in each path, so that the intensities and the polarization states of the branched optical pulses are equal after being multiplexed.

Regarding the polarization controller, Examiner takes Official Notice that such a device is well known in the art. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to employ a polarization controller through which the optical pulses output by said optical pulse source of Sharma pass. One of ordinary skill in the art would have been motivated to do this for the common purpose of providing any particular arbitrary polarization state to the optical pulses of Sharma.

Regarding the variable optical attenuator, Examiner takes Official Notice that such a device is well known in the art. At the time the invention was made, it would have been obvious to one of ordinary skill in the art to employ a variable optical attenuator arranged in each path of Sharma. One of ordinary skill in the art would have been motivated to do this to provide fine amplitude/intensity control of each optical pulse.

Regarding the variable delay unit, such a device is well known in the art, as shown by Hall (252 in Fig. 8). At the time the invention was made, it would have been obvious to one of ordinary skill in the art to employ a variable delay unit arranged in each path of Sharma. One of ordinary skill in the art would have been motivated to do this to relieve the need to control the precise length of each path (Hall, paragraph [0101]), thus easing manufacturing tolerances.

Response to Arguments

9. Applicant's arguments filed 05 November 2007 have been fully considered but they are not persuasive. Applicant's arguments are based on limitations newly introduced by amendment. In particular, notice the new limitation of "so that intensities and polarization states of the branched optical pulses are equal after being multiplexed" in the independent claims. However, this new limitation does not overcome the teachings of Sharma, i.e., notice the uniform height and co-planar characteristics of the pulses in the pulse diagram above star coupler 62, implying equal intensities and polarization states.

Also, notice the new limitations of new claim 12. The standing rejections rely on an obviousness argument to address these new limitations. Accordingly, Applicant's arguments are not persuasive.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Kim whose telephone number is 571-272-3033. The examiner can normally be reached on Mon.-Fri. 9 AM to 5 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth N. Vanderpuye can be reached on 571-272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DSK

KENNETH VANDERPUYE
SUPERVISORY PATENT EXAMINER